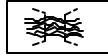


## **STD & SPEC 3.24**

### **TEMPORARY VEHICULAR STREAM CROSSING**



#### **Practice Description**

A temporary structural span installed across a flowing watercourse for use by construction traffic. Structures may include bridges, round pipes, pipe arches, or oval pipes, which provide a means for construction traffic to cross flowing streams without damaging the channel or banks, and keep sediment generated by construction traffic out of the stream.

#### **Conditions Where Practice Applies**

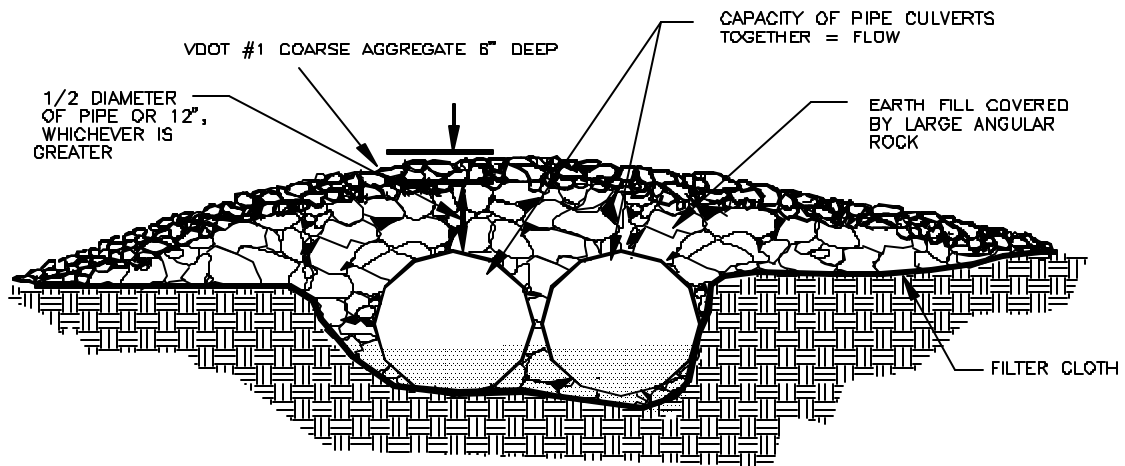
Generally applicable to flowing streams with drainage areas less than 1 square mile. Structures that must handle flow from larger drainage areas should be designed by methods that more accurately define the actual hydrologic and hydraulic parameters that will affect the functioning of the structure.

#### **Construction Specifications**

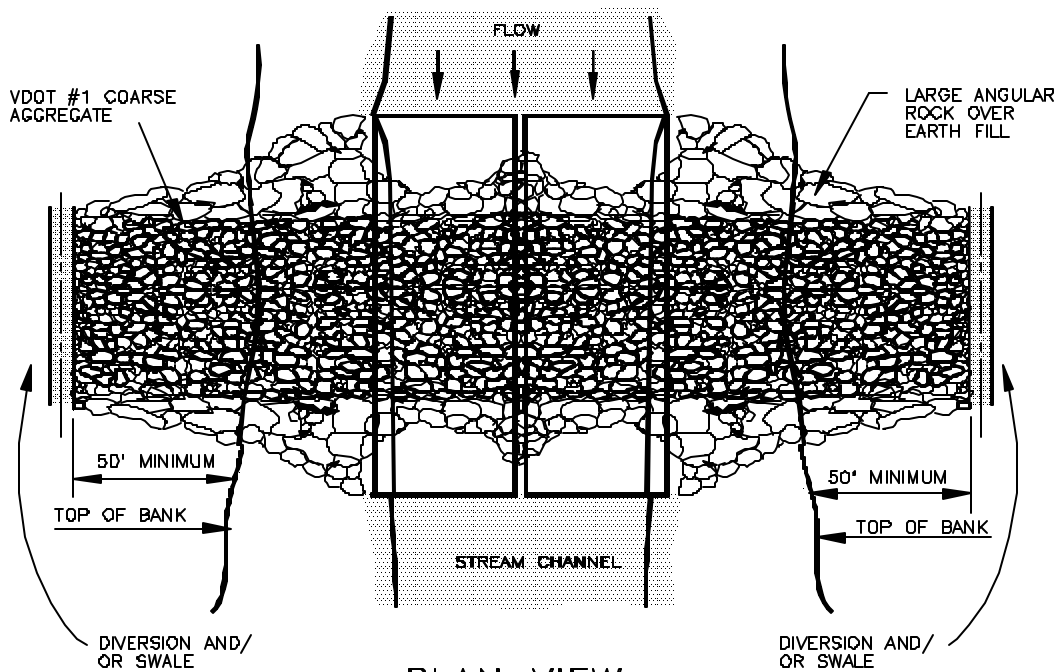
##### **Temporary Culvert Crossing**

- a. Clearing and excavation of the stream bed and banks shall be kept to a minimum.
- b. The invert elevation of the culvert shall be installed on the natural streambed grade to minimize interference with fish migration.
- c. Filter cloth shall be placed on the streambed and streambanks prior to placement of the pipe culvert(s) and aggregate. The filter cloth shall cover the streambed and extend a minimum of six inches and a maximum of one foot beyond the end of the culvert and bedding material. Filter cloth reduces settlement and improves crossing stability. See Std. & Spec. 3.19, RIPRAP, for required physical qualities of the filter cloth.
- d. The culvert(s) shall extend a minimum of one foot beyond the upstream and downstream toe of the aggregate placed around the culvert. In no case shall the culvert exceed 40 feet in length .

# TEMPORARY CULVERT CROSSING



ELEVATION



PLAN VIEW

SOURCE: VA. DSWC

PLATE. 3.24-2

- e. The culvert(s) shall be covered with a minimum of one foot of aggregate. If multiple culverts are used, they shall be separated by at least 12 inches of compacted aggregate fill. At a minimum, the bedding and fill material used in the construction of the temporary access culvert crossings shall conform with the aggregate requirements cited in part "i" under "Temporary Culvert Crossing."
- f. When the crossing has served its purpose, all structures including culverts, bedding and filter cloth materials shall be removed. Removal of the structure and clean-up of the area shall be accomplished without construction equipment working in the waterway channel.
- g. Upon removal of the structure, the stream shall immediately be shaped to its original cross-section and properly stabilized.

#### **Maintenance**

Structures shall be inspected after every rainfall and at least once a week, whether it has rained or not, and all damages repaired immediately.

## STD & SPEC 3.25 UTILITY STREAM CROSSING



### **Practice Description**

A strategy for crossing small waterways when in-stream utility construction is involved; utilized to help protect sediment from entering the stream from construction within approach areas and to minimize the amount of disturbance within the stream itself.

### **Conditions Where Practice Applies**

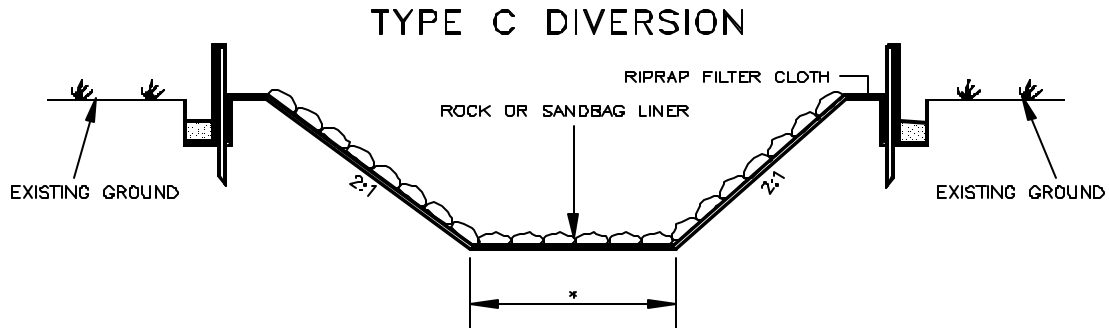
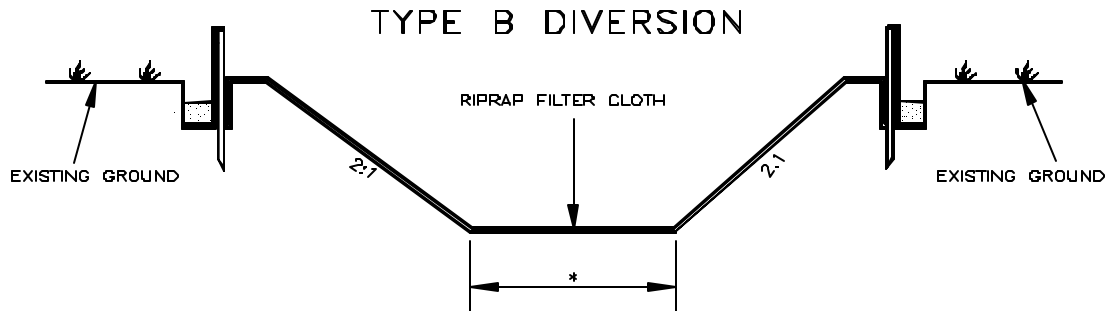
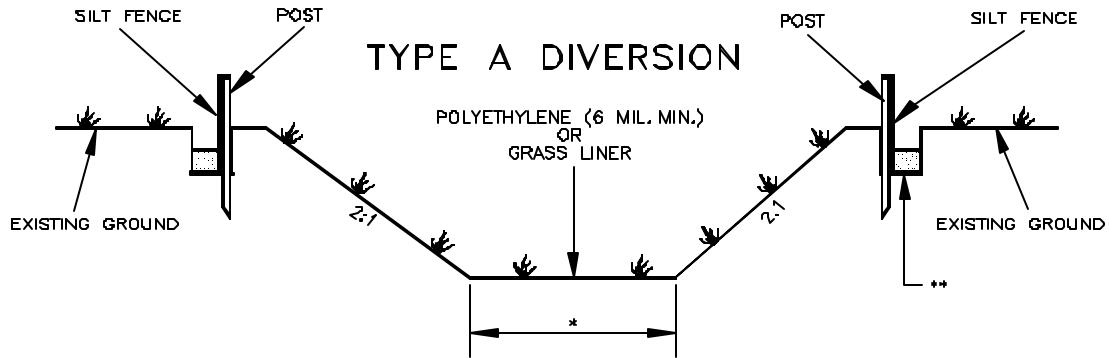
Practice generally applicable to flowing streams with drainage areas less than one square mile. Structures or methodology for crossing streams with larger drainage areas should be designed by methods that more accurately define the actual hydrologic and hydraulic parameters that will affect the functioning of the structure.

### **Construction Specifications**

1. Diversion Channel Crossing - Preferred method if construction will remain in area of stream for an extended period (longer than 72 hours) and site conditions (such as width of stream) make diversion practical.
  - a. The diversion channel crossing must be operational before work is done in the stream (construction will be performed "in the dry").
  - b. Minimum width of bottom shall be six feet or equal to bottom width of existing streambed, whichever is greater. Refer to Plate 3.25-2.
  - c. Maximum steepness of side slopes shall be 2:1. Depth and grade may be variable, dependent on site conditions, but shall be sufficient to ensure continuous flow of water in the diversion.
  - d. There are three types of diversion channel linings that can be used, based upon expected velocity of bankfull flow. Refer to Plate 3.25-2 and the following table:

# DIVERSION CHANNEL CROSSING

## ACCEPTABLE LININGS (CROSS SECTION A-A OF PLATE 3.25-1)



\* 6' MINIMUM OR WIDTH OF EXISTING STREAM WHICHEVER IS LESS

\*\* ENTRENCH SILT FENCE AND FILTER CLOTH IN SAME TRENCH

SOURCE: ADAPTED FROM VDOT STANDARDS

PLATE. 3.25-2

**TABLE 3.25-A  
DIVERSION CHANNEL LININGS**

<u>Lining Material</u>	<u>Classifications</u>	<u>Velocity</u>
Filter Cloth*, Polyethylene or Grass	TYPE A	0 - 2.5 f.p.s
Filter Cloth*	TYPE B	2.5 - 9.0 f.p.s.
Class I Riprap and Filter Cloth*	TYPE C	9.0 - 13.0 f.p.s.

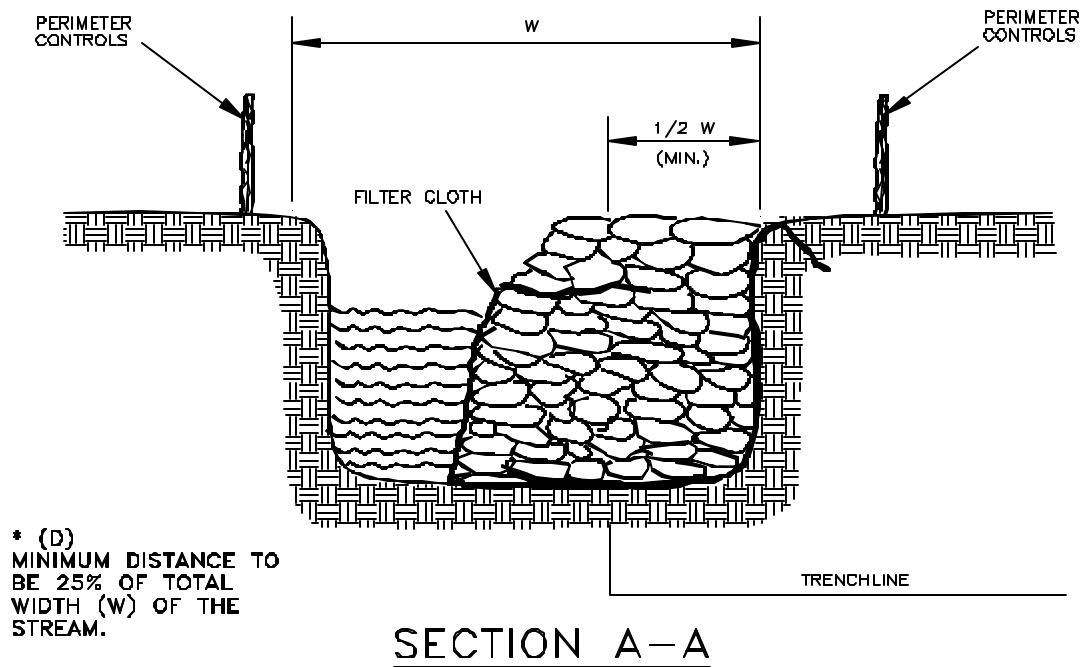
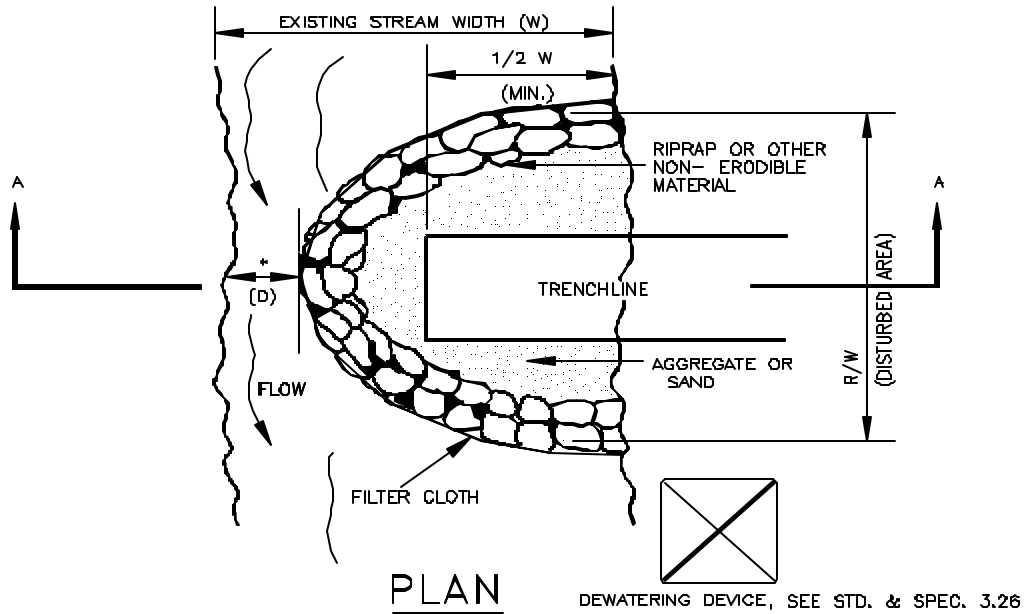
\* Filter Cloth must meet the minimum physical requirements in Std. & spec. 3.19, RIPRAP.

- e. Type A stream diversions may be seeded with a standard seed mix for the type of soils encountered and the time of year seed is sown. An average growth of two inches in height shall be achieved throughout the diversion with an 85% cover before water is turned through it.
- f. Stream diversion liners shall be secured at the upstream and downstream sides with non-erodible weights such as riprap. These weights shall allow normal flow of the stream. Soil shall not be mixed in with stream diversion weights. Weights may also be needed along the stream diversion's length to secure liner.
- g. Stream diversion liners should be overlapped when single or continuous liner is not available or is impractical. Overlaps should be such that continuous flow of the stream is maintained. An upstream section should overlap a downstream section by a minimum of 18 inches. Overlaps along the cross-section should be made such that a liner is placed in the stream diversion bottom first and additional pieces of liner on the slopes overlap the bottom piece by a minimum of 18 inches.
- h. Stream diversion liners shall be entrenched at the top of the diversion slopes (slopes breaks) along with a line of silt fence. Silt fence may be excluded if the diversion liner is extended to such a point that siltation of the stream will not occur. If silt fence is excluded, the diversion liner must be secured. Liners shall extend from slope break to slope break as shown in Plate 3.25-2.
- i. Staples used in securing SOIL STABILIZATION BLANKETS AND MATTING (see Std. & Spec. 3.36) or non-erodible weights (riprap) shall be used as necessary to anchor stream diversion liners to the side slopes of the diversion. Wooden stakes should not be used on the diversion's bottom or side slopes.

- j. Non-erodible materials such as riprap, jersey barriers, sandbags, plywood, or sheet piling, shall be used as flow barriers to divert the stream away from its original channel and to prevent or reduce water backup into a construction area.
  - k. The downstream flow barrier is to be removed prior to the upstream barrier when opening a stream diversion for the transport of water.
  - l. Streams should be rediverted upon completion of the utility crossing for which the diversion was built. Prior to rediversion, any materials (flow barrier) used to prevent water backup into the downstream end of the original streambed shall be removed. This material should not be placed in the downstream end of the diversion until after water has been rediverted to the original waterway. The stream should then be rediverted by removing all of the materials damming the upstream end of the original streambed and then placing it in the upstream end of the stream diversion. The diversion should be sealed off at the downstream end and then backfilled. Once started, any work to relocate a stream shall not be discontinued until it is completed.
  - m. Stream should be rediverted only after backfilling and restabilization of original streambed and banks is completed. Restabilization shall consist of the installation of ungrouted riprap on all disturbed streambank areas (or on the area 6 feet on both sides of the centerline of its utility trench, whichever is greater) with slopes of 3:1 or greater. Refer to Std. & Spec. 3.19, RIPRAP, for installation requirements. For slopes of 3:1 or less, vegetative stabilization may be used, pending approval by the Plan-Approving Authority or inspection authority.
- Stabilization of its streambed and banks and the approach areas should occur immediately following the attainment of final grade.
- n. Any dewatering discharge from this operation shall be placed into an approved DEWATERING STRUCTURE (see Std. & Spec. 3.26).
2. Cofferdam Utility Crossing - To be used when stream diversion is not practical and stream is wide enough (10 feet or wider) to make cofferdam installation practical.
- a. Construction is to be performed in low flow periods.
  - b. Crossing shall be accomplished in a manner that will not prohibit the flow of the stream. (see Plate 3.25-4).
  - c. As with all utility line crossings, approach areas must be controlled with perimeter measures such as silt fence or straw bales.
  - d. Remove large rocks, woody vegetation, or other material from the streambed and banks that may get in the way of placing the riprap, sandbags, sheet metal, or wood planks or installing the utility pipe or line.

- e. Form a cofferdam by placing the riprap (or other non-erodible materials) in a semicircle along the side of the stream in which the utility installation will begin. It must be surrounded and underlain with filter cloth as shown in Plate 3.25-4. The height of and area within the dam will depend upon the size of the work area and the amount of stream flow. Stack materials as high as will be necessary to keep water from overtopping the dam and flooding the work area. When the stream flow is successfully diverted by the cofferdam, dewater the work area and stabilize it with aggregate (VDOT #57 or #68 Coarse Aggregate) or sand. Make sure to discharge the water into a sediment trapping device (see DEWATERING STRUCTURE, Std. & Spec. 3.26).
- f. Install the utility pipe or line in half the streambed as noted in Plate 3.25-4. Remove the riprap or other materials and begin placing them on the other side of the stream.
- g. Restabilization shall consist of the installation of ungrouted riprap on all disturbed streambank areas (or on the area 6 feet on both sides of the centerline of its utility trench, whichever is greater) with slopes of 3:1 or greater. Refer to Std. & Spec. 3.19, RIPRAP, for installation requirements. For slopes of 3:1 or less, vegetative stabilization may be used, pending approval by Plan-Approving Authority or inspection authority. Stabilization of its streambed and banks and the approach areas should occur immediately following the attainment of final grade.

# COFFERDAM CROSSING



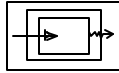
SOURCE: FORD, BACON, & DAVIS, INC.

PLATE. 3.25-4

### **Maintenance**

Care must be taken to inspect any stream crossing area at the end of each day to make sure that the construction materials are positioned securely. This will ensure that the work area stays dry and that no construction materials float downstream.

## STD & SPEC 3.26 DEWATERING STRUCTURE



### **Practice Description**

A temporary settling and filtering device for water which is discharged from dewatering activities, used to filter sediment-laden water prior to the water being discharged off-site.

### **Conditions Where Practice Applies**

Wherever sediment-laden water must be removed from a construction site by means of pumping.

### **Construction Specifications**

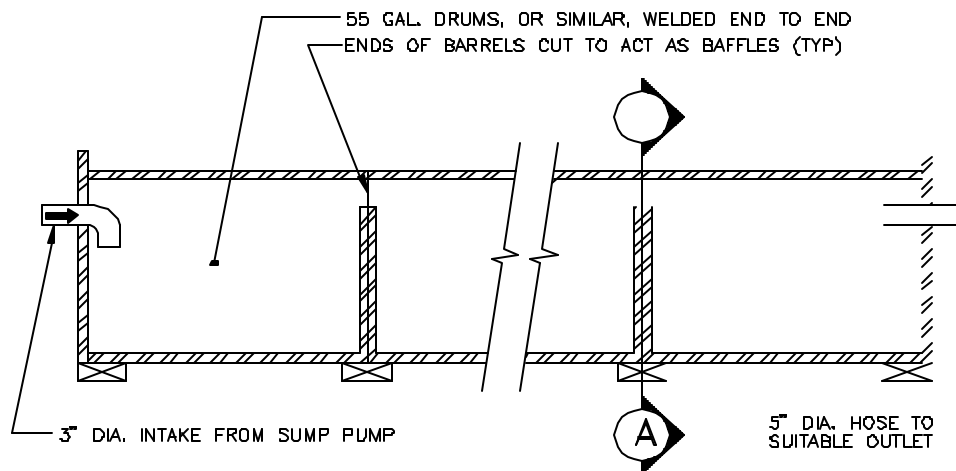
#### 1. Portable Sediment Tank (see Plate 3.26-1)

- a. The structure may be constructed with steel drums, sturdy wood or other material suitable for handling the pressure exerted by the volume of water.
- b. Sediment tanks will have a minimum depth of two feet.
- c. The sediment tank shall be located for easy clean-out and disposal of the trapped sediment and to minimize the interference with construction activities.
- d. The following formula shall be used to determine storage volume of the sediment tank:

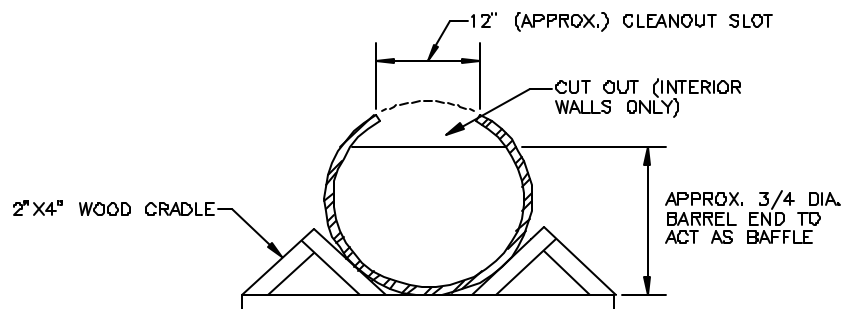
$$\text{Pump discharge (g.p.m.)} \times 16 = \text{cubic feet of storage required.}$$

- e. Once the water level nears the top of the tank, the pump must be shut off while the tank drains and additional capacity is made available.
- f. The tank shall be designed to allow for emergency flow over top of the tank.
- g. Clean-out of the tank is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.

# PORTABLE SEDIMENT TANK



ELEVATION



CROSS-SECTION A-A

2. Straw Bale/Silt Fence Pit (see Plate 3.26-3)

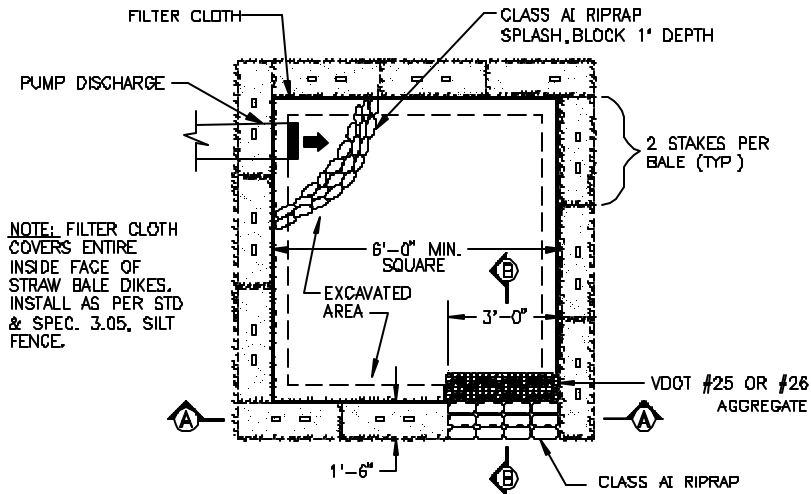
- a. Measure shall consist of straw bales, silt fence, a stone outlet (a combination of VDOT Class AI Riprap and VDOT #25 or #26 Aggregate) and a wet storage pit oriented as shown in Plate 3.26-3.
- b. The structure must have a capacity that is dictated by the following formula:

$$\text{Pump discharge (g.p.m.)} \times 16 = \text{cubic feet of storage required.}$$

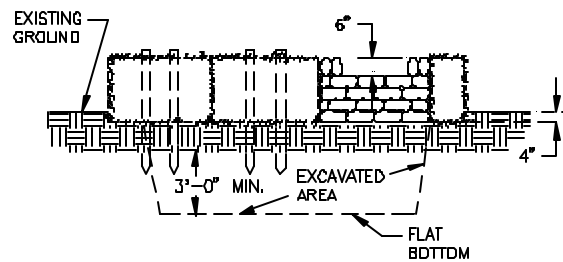
In calculating the capacity, one should include the volume available from the floor of the excavation to the crest of the stone weir.

- c. In any case, the excavated area should be a minimum of 3 feet below the base of the perimeter measures (straw bales or silt fence).
- d. The perimeter measures must be installed as per the guidelines found in Std. & Spec. 3.04, STRAW BALE BARRIER and Std. & Spec. 3.05, SILT FENCE.
- e. Once the water level nears the crest of the stone weir (emergency overflow), the pump must be shut off while the structure drains down to the elevation of the wet storage.
- f. The wet storage pit may be dewatered only after a minimum of 6 hours of sediment settling time. This effluent should be pumped across a well-vegetated area or through a silt fence prior to entering a watercourse.
- g. Once the wet storage area becomes filled to one-half of the excavated depth, accumulated sediment shall be removed and properly disposed of.
- h. Once the device has been removed, ground contours will be returned to original condition.

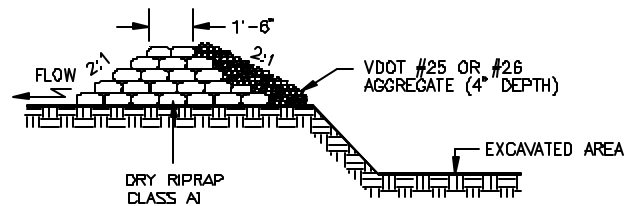
*STRAW BALE/SILT FENCE PIT*



### PLAN VIEW



CROSS-SECTION A-A



CROSS-SECTION B-B

SOURCE: Va. DSWC

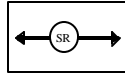
PLATE: 3.26-3

### **Maintenance**

(All dewatering structures)

1. The filtering devices must be inspected frequently and repaired or replaced once the sediment build-up prevents the structure from functioning as designed.
2. The accumulated sediment that is removed from a dewatering device must be spread on-site and stabilized or disposed of at an approved disposal site as per approved plan.

## STD & SPEC 3.29 SURFACE ROUGHENING



### Practice Description

Providing a rough soil surface with horizontal depressions created by operating a tillage or other suitable implement on the contour, or by leaving slopes in a roughened condition by not fine-grading them, to aid in establishment of vegetative cover with seed, reduce runoff velocity and increase infiltration, and to reduce erosion and provide for sediment trapping.

### Conditions Where Practice Applies

1. All slopes steeper than 3:1 require surface roughening, either stair-step grading, grooving, furrowing, or tracking if they are to be stabilized with vegetation.
2. Areas with grades less steep than 3:1 should have the soil surface lightly roughened and loose to a depth of 2 to 4 inches prior to seeding.
3. Areas which have been graded and will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
4. Slopes with a stable rock face do not require roughening or stabilization.

### Specifications

#### Cut Slope Applications For Areas Which Will Not Be Mowed

Cut slopes with a gradient steeper than 3:1 shall be stair-step graded or grooved (Plates 3.29-1 and 3.29-2).

1. Stair-step grading may be carried out on any material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.

The ratio of the vertical cut distance to the horizontal distance shall be less than 1:1 and the horizontal portion of the "step" shall slope toward the vertical wall. Individual vertical cuts shall not be more than 30 inches on soft soil materials and not more than 40 inches in rocky materials.

2. Grooving consists of using machinery to create a series of ridges and depressions which run perpendicular to the slope (on the contour).

Grooves may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction. Suggested implements include discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Such grooves shall not be less than 3 inches deep nor further than 15 inches apart.

#### Fill Slope Applications For Areas Which Will Not Be Mowed

Fill slopes with a gradient steeper than 3:1 shall be grooved or allowed to remain rough as they are constructed. Method (1) or (2) below may be used.

1. Groove according to #2 above.
2. As lifts of the fill are constructed, soil and rock materials may be allowed to fall naturally onto the slope surface.

Colluvial materials (soil deposits at the base of slopes or from old stream beds) shall not be used in fills as they flow when saturated.

At no time shall slopes be bladed or scraped to produce a smooth, hard surface.

#### Cuts, Fills, and Graded Areas Which Will Be Mowed

Mowed slopes should not be steeper than 3:1. Excessive roughness is undesirable where mowing is planned. These areas may be roughened with shallow grooves such as remain after tilling, discing, harrowing, raking, or use of a cultipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).

Grooves formed by such implements shall be not less than 1-inch deep and not further than 12-inches apart. Fill slopes that are left rough as constructed may be smoothed with a dragline or pickchain to facilitate mowing.

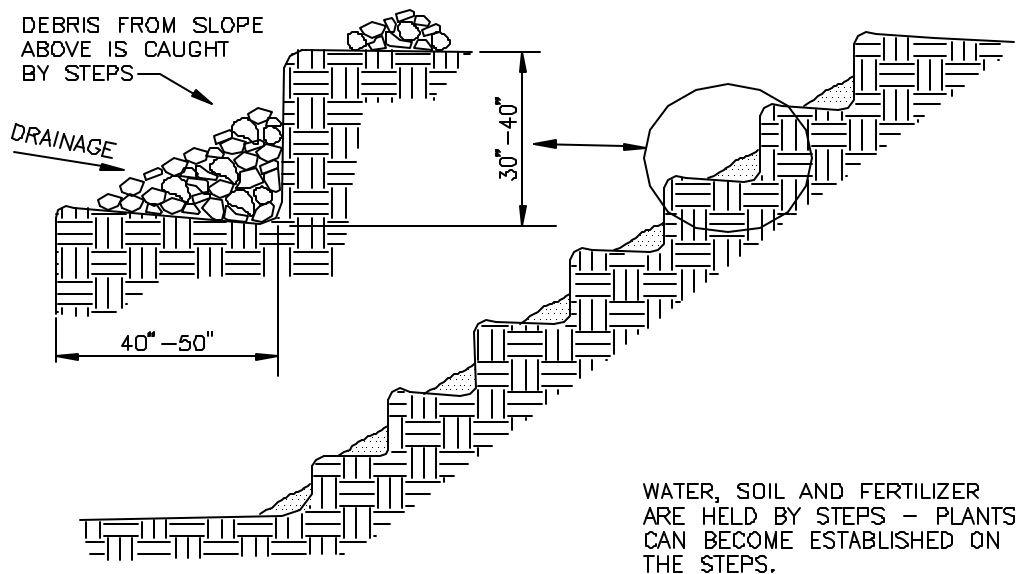
#### Roughening With Tracked Machinery

Roughening with tracked machinery on clayey soils is not recommended. Undue compaction of surface soil results from this practice. Sandy soils do not compact severely, and may be tracked. When tracking is the chosen surface roughening technique, it shall be done by operating tracked machinery **up and down the slope** to leave horizontal depressions in the soil. As few passes of the machinery should be made as possible to minimize compaction.

#### Seeding

Roughened areas shall be seeded and mulched as soon as possible to obtain optimum seed germination and seedling growth.

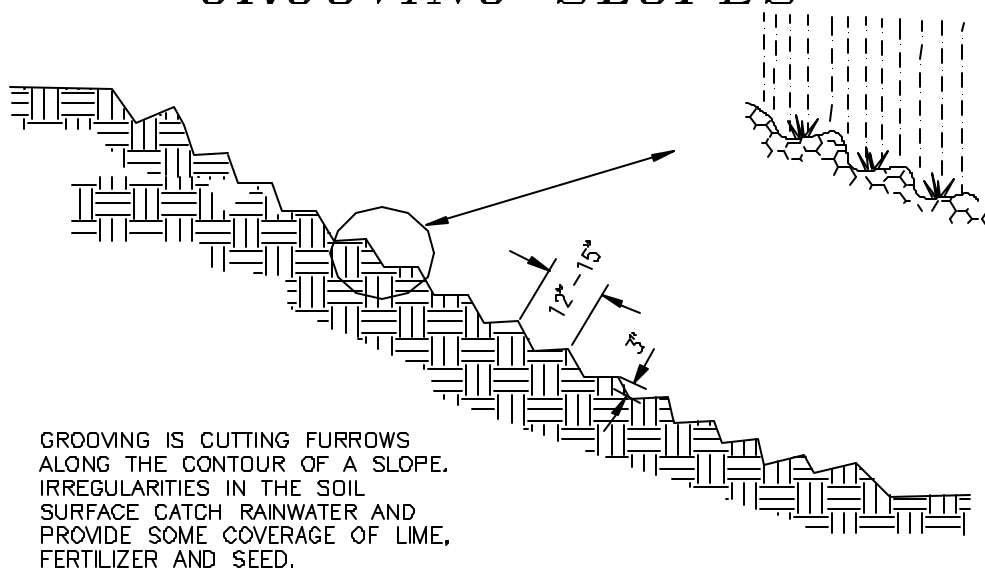
## STAIR STEPPING CUT SLOPES



SOURCE: VA. DSWC

PLATE 3.29-1

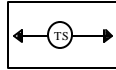
## GROOVING SLOPES



SOURCE: VA. DSWC

PLATE 3.29-2

## STD & SPEC 3.31 TEMPORARY SEEDING



### Practice Description

The establishment of a temporary vegetative cover on disturbed areas by seeding with appropriate rapidly growing annual plants; employed to reduce erosion and sedimentation by stabilizing disturbed areas that will not be brought to final grade for a period of more than 30 days, to reduce damage from sediment and runoff to downstream or off-site areas, and to provide protection to bare soils exposed during construction until permanent vegetation or other erosion control measures can be established.

### Conditions Where Practice Applies

Where exposed soil surfaces are not to be fine-graded for periods longer than 30 days. Such areas include denuded areas, soil stockpiles, dikes, dams, sides of sediment basins, temporary roadbanks, etc. (see MS #1 and MS #2). A permanent vegetative cover shall be applied to areas that will be left dormant for a period of more than 1 year.

### Specifications

#### Plant Selection

Select plants that are appropriate to the season and site conditions. An extensive description of some of the plants that are commonly utilized for temporary seeding can be found in Appendix 3.31-a.

Seedbed Preparation: To control erosion on bare soil surfaces, plants must be able to germinate and grow. Seedbed preparation is essential.

1. Liming: An evaluation should be conducted to determine if lime is necessary for temporary seeding. In most soils, it takes up to 6 months for a pH adjustment to occur following the application of lime. Therefore, it may be difficult to justify the cost of liming a temporary site, especially when the soil will later be moved and regraded. The following table may be used to determine the actual need along with suggested application rates.

**TABLE 3.31-A  
LIMING REQUIREMENTS FOR TEMPORARY SITES**

<u>pH Test</u>	<u>Recommended Application</u>
below 4.2	3 tons per acre
4.2 to 5.2	2 tons per acre
5.2 to 6	1 ton per acre

2. Fertilizer: Shall be applied as 600 lbs./acre of 10-20-10 (14 lbs./1,000 sq. ft.) or equivalent nutrients. Lime and fertilizer shall be incorporated into the top 2 to 4 inches of the soil if possible.
3. Surface Roughening: If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted, or hardened, the soil surface shall be loosened by discing, raking, harrowing, or other acceptable means (see SURFACE ROUGHENING, Std. & Spec. 3.29).
4. Tracking: Tracking with bulldozer cleats is most effective on sandy soils. This practice often causes undue compaction of the soil surface, especially in clayey soils, and does not aid plant growth as effectively as other methods of surface roughening

Seeding: Seed shall be evenly applied with a broadcast seeder, drill, cultipacker seeder or hydroseeder. Small grains shall be planted no more than 1½ inches deep. Small seeds, such as Kentucky Bluegrass, should be planted no more than 1/4 inch deep. Other Grasses and Legumes should be planted from 1/4 inch to 1/2 inch deep.

Mulching:

1. Seedings made in fall for winter cover and during hot and dry summer months shall be mulched according to MULCHING, Std. & Spec. 3.35, except that hydromulches (fiber mulch) will not be considered adequate. Straw mulch should be used during these periods.
2. Temporary seedings made under favorable soil and site conditions during optimum spring and fall seeding dates may not require mulch.

Re-seeding: Areas which fail to establish vegetative cover adequate to prevent rill erosion will be re-seeded as soon as such areas are identified.

**TABLE 3.31-B**  
**ACCEPTABLE TEMPORARY SEEDING PLANT MATERIALS**  
**"QUICK REFERENCE FOR ALL REGIONS"**

<u>Planting Dates</u>	<u>Species</u>	<u>Rate (lbs/acre)</u>
Sept. 1 - Feb. 15	50/50 Mix of Annual Ryegrass ( <u>Lolium multi-florum</u> ) & Cereal (Winter) Rye ( <u>Secale cereale</u> )	50 - 100
Feb. 16 - Apr. 30	Annual Ryegrass ( <u>Lolium multi-florum</u> )	60 - 100
May 1 - Aug. 31	German Millet ( <u>Setaria italica</u> )	50

## APPENDIX 3.31 - a

### PLANT INFORMATION SHEETS

1. **Oats** (*Avenasativa*): A cool season annual grass primarily grown for animal feed and human consumption, but also used for soil stabilization. Oats are seeded in early spring in the western part of the state (winter oats may be sown in the Coastal Plain). Seeding rates are 3 bushels (100 lbs.) per acre bare ground or 2-1/2 lbs. per 1000 square feet.
2. **Rye** (*Secale cereale*): Often referred to as Winter Rye because of its winter hardiness, Rye is the most common small grain used for soil stabilization. It is also the most productive grain on dry, infertile, acid or sandy soils. It may be seeded in the fall for winter ground cover. By maturing early, it offers less competition during the late spring period, a critical time in the establishment of perennial species. Rye grain germinates quickly and is tolerant of poor soils. \* Including Rye grain in fall-seeded mixtures is almost always advantageous, but it is particularly helpful on difficult and erodible soils, erodible slopes or when seeding is late. Rates up to 100 lbs. per acre for bare ground. Overly thick stands of Rye grain will suppress the growth of perennial seedlings. Approximately 50 lbs. per acre is the maximum for this purpose and, where lush growth is expected, that rate should either be cut in half or totally eliminated from the mixture.
3. **Foxtail Millet** (*Setaria italica*): A warm season annual grass which may be used for temporary cover. German Millet (variety commonly used in Virginia) germinates quickly and goes to seed quickly. These features make it an excellent companion grass for summer seedings. It dies at first frost. Seeding rates are up to 50 lbs. per acre for temporary cover. Use 10 to 20 lbs. per acre in mixes.
4. **Annual Rye** (*Lolium multiflorum*): A cool season annual grass used for temporary cover or as a nurse grass to allow for germination of permanent stands. Most commonly used in mixes for erosion control. Performs well throughout the state in neutral to slightly acid soils. Rates up to 100 lbs. per acre for temporary cover. Use 10 to 20 lbs. per acre in mixes.
5. **Annual Lespedezas** (*Lespedeza striata*)

Uses: Pasture, hay, erosion control, soil improvement, wildlife food.

Description: Annual warm season legumes. Korean Lespedeza is larger and coarser than Common Lespedeza and grows to about 12 inches. Seed of Korean is shiny and black, while seed of Common is stippled. Kobe is the most desirable variety of Common Lespedeza.

Adaptation: Throughout Virginia. Optimum pH range is 6.0 to 6.5; will grow from 5.5 to 7.0. Will grow in soil textures ranging from sands to clays and though a wide range of fertility conditions.

Establishment: Seed should always be inoculated. May be seeded alone or mixed with grasses or small grains. Requires a firm seedbed; may be broadcast or drilled. Should be seeded in early spring at 25 to 40 lbs. per acre or one-half to 1 lb. per 1000 square feet, depending on use. (Use lower figure as half

the seeding rate of any spring seeding with grass or grain). Should not be mowed at less than three inches. Lespedeza will not make a large contribution in sod grasses like Bluegrass; they do best in open sod grasses like tall fescue.

6. **Weeping Lovegrass** (*Eragrostis curvula*)

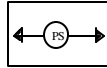
Uses: Fast-growing cover for erosion control. In the northeast, weeping lovegrass acts as a summer annual. The normal life of 3 to 5 years may be foreshortened by low winter temperatures. May provide permanent cover on southern exposure.

Description: A rapid-growing, warm season bunch grass introduced from East Africa. The long, narrow leaves are numerous, very fine, and droop over to the ground, hence the name. Leaf height is rarely above 12 inches.

Adaptation: Prefers light-textured, well-drained soil; will thrive on soil of low fertility. Low winter temperatures may deplete stand.

Establishment: Easy to establish by seed; germinates rapidly and grows quickly. Lime and fertilizer needs are similar to those of Tall Fescue and Ryegrass. Requires pH of 5.5 or higher. May be planted any time after danger of frost and throughout the summer. Very fine seed, commonly added to erosion control seed mixtures. Use of hydroseeders is successful if the seeding rate is increased to compensate for the lack of a firm seedbed. Normal seeding rates are 5 to 20 lbs. per acre in mixes.

## STD & SPEC 3.32 PERMANENT SEEDING



### **Practice Description**

The establishment of perennial vegetative cover on disturbed areas by planting seed. It is utilized for the following:

1. To reduce erosion and decrease sediment yield from disturbed areas.
2. To permanently stabilize disturbed areas in a manner that is economical, adaptable to site conditions, and allows selection of the most appropriate plant materials.
3. To improve wildlife habitat.
4. To enhance natural beauty.

### **Conditions Where Practice Applies**

1. Disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil.
2. Rough-graded areas which will not be brought to final grade for a year or more.

### **Specifications**

#### **Selection of Plant Materials**

1. Selection of plant materials is based on climate, topography, soils, land use, and planting season.
2. An extensive description of some of the plants which are commonly utilized for permanent seeding can be found in Appendix 3.32-c. Plate 3.32-1 shows plant hardiness zones for grasses and legumes for Virginia's two major climate regions:

3. Appropriate seeding mixtures for various site conditions in Virginia are given in Tables 3.32-A, 3.32-B and 3.32-C. These mixtures are designed for general use, and are known to perform well on the sites described.
4. When using some varieties of turfgrasses, the Virginia Crop Improvement Association (VCIA) recommended turfgrass mixtures may also be used. Consumer protection programs have been devised to identify quality seed of the varieties recommended by the Virginia Cooperative Extension Service. These will bear a label indicating that they are approved by the Association. Mixtures may be designed for a specific physiographic region or based on intended use. Special consideration is given to plant characteristics, performance, etc.

**TABLE 3.32-A  
SITE SPECIFIC SEEDING MIXTURES  
FOR APPALACHIAN/MOUNTAIN AREA**

<u>Minimum Care Lawn</u>	<u>Total Lbs. Per Acre</u>
- Commercial or Residential	200-250 lbs.
- Kentucky 31 or Turf-Type Tall Fescue	90-100%
- Improved Perennial Ryegrass	0-10%
- Kentucky Bluegrass	0-10%
 <u>High-Maintenance Lawn</u>	
Minimum of three (3) up to five (5) varieties of bluegrass from approved list for use in Virginia.	125 lbs.
 <u>General Slope (3:1 or less)</u>	
- Kentucky 31 Fescue	128 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	<u>20 lbs.</u>
	150 lbs.
 <u>Low-Maintenance Slope (Steeper than 3:1)</u>	
- Kentucky 31 Fescue	108 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	20 lbs.
- Crownvetch **	<u>20 lbs.</u>
	150 lbs.
*Use seasonal nurse crop in accordance with seeding dates as stated below:	
March, April through May 15th.....	Annual Rye
May 16th through August 15th.....	Foxtail Millet
August 16th through September, October.....	Annual Rye
November through February.....	Winter Rye
**If Flatpea is used, increase to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may also be included in any slope or low- maintenance mixture during warmer seeding periods; add 10-20 lbs./acre in mixes.	

**TABLE 3.32-B  
SITE SPECIFIC SEEDING MIXTURES FOR  
PIEDMONT AREA**

	Total lbs
<u>Minimum Care Lawn.</u>	<u>Per Acre</u>
- Commercial or Residential	175-200 lbs.
- Kentucky 31 or Turf-Type Tall Fescue	95-100%
- Improved Perennial Ryegrass	0-5%
- Kentucky Bluegrass	0-5%
<u>High-Maintenance Lawn</u>	200-250 lbs.
Kentucky 31 or Turf-Type Tall Fescue	100%
<u>General Slope (3:1 or less)</u>	
- Kentucky 31 Fescue	128 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	<u>20 lbs.</u>
	150 lbs.
<u>Low-Maintenance Slope (Steeper than 3:1)</u>	
- Kentucky 31 Fescue	108 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	20 lbs.
- Crownvetch **	<u>20 lbs.</u>
	150 lbs.

\*Use seasonal nurse crop in accordance with seeding dates as stated below:

February 16th through April.....	Annual Rye
May 1st through August 15th.....	Foxtail Millet
August 16th through October.....	Annual Rye
November through February 15th.....	Winter Rye

\*\*Substitute Sericea lespedeza for Crownvetch east of Farmville, Va.

(May through September use hulled Sericea, all other periods, use unhulled Sericea). If Flatpea is used in lieu of Crownvetch, increase rate to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may be added to any slope or low-maintenance mix during warmer seeding periods; add 10-20 lbs./acre in mixes.

**TABLE 3.32-C  
SITE SPECIFIC SEEDING MIXTURES  
FOR COASTAL PLAIN AREA**

<u>Minimum Care Lawn</u>	<u>Total Lbs Per Acre</u>
- Kentucky 31 or Turf-Type Tall Fescue	175-200 lbs.
<b>or</b>	
- Common Bermudagrass **	75 lbs.
 <u>High-Maintenance Lawn</u>	
- Kentucky 31 or Turf-Type Tall Fescue	200-250 lbs.
<b>or</b>	
- Hybrid Bermudagrass (seed) **	40 lbs. (unhulled)
<b>or</b>	30 lbs. (hulled)
 <u>General Slope (3:1 or less)</u>	
- Kentucky 31 Fescue	128 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	<u>20 lbs.</u>
	150 lbs.
 <u>Low Maintenance Slope (Steeper than 3:1)</u>	
- Kentucky 31 Tall Fescue	93-108 lbs.
- Common Bermudagrass **	0-15 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop *	20 lbs.
- Sericea Lespedeza **	<u>20 lbs.</u>
	150 lbs.

\* Use seasonal nurse crop in accordance with seeding dates as stated below:

February, March through April.....Annual Rye  
May 1st through August.....Foxtail Millet  
September, October through November 15th.....Annual Rye  
November 16th through January.....Winter Rye

\*\* May through October, use hulled seed. All other seeding periods, use unhulled seed.

Weeping Lovegrass may be added to any slope or low-maintenance mix during warmer seeding periods; add 10-20 lbs./acre in mixes.

Seedbed Requirements: Vegetation should not be established on slopes that are unsuitable due to inappropriate soil texture, poor internal structure or internal drainage, volume of overland flow, or excessive steepness, until measures have been taken to correct these problems.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil must have these characteristics:

1. Enough fine-grained material to maintain adequate moisture and nutrient supply.
2. Sufficient pore space to permit root penetration. A bulk density of 1.2 to 1.5 indicates that sufficient pore space is present. A fine granular or crumb-like structure is also favorable.
3. Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans shall be 12 inches or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.
4. A favorable pH range for plant growth. If the soil is so acidic that a pH range of 6.0-7.0 cannot be attained by addition of pH-modifying materials, then the soil is considered an unsuitable environment for plant roots and further soil modification would be required.
5. Freedom from toxic amounts of materials harmful to plant growth.
6. Freedom from excessive quantities of roots, branches, large stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they do not significantly impede good seed soil contact.

If any of the above criteria cannot be met, i.e., if the existing soil is too coarse, dense, shallow, acidic, or contaminated to foster vegetation, then topsoil shall be applied in accordance with TOPSOILING, Std. & Spec. 3.30. Surfaces will be roughened in accordance with SURFACE ROUGHENING Std. & Spec. 3.29.

#### Soil Conditioners

In order to modify the texture, structure, or drainage characteristics of a soil, the following materials may be added to the soil:

1. Peat: is a very costly conditioner, but works well. If added, it shall be sphagnum moss peat, hypnum moss peat, reed-sedge peat or peat humus, from fresh-water sources. Peat shall be shredded and conditioned in storage piles for at least six months after excavation.
2. Sand: shall be clean and free of toxic materials. Sand modification is ineffective unless you are adding 80 to 90% sand on a volume basis. This is extremely difficult to do on-site. If this practice is considered, consult a professional authority to ensure that it is done properly.
3. Vermiculite: shall be horticultural grade and free of toxic substances. It is an impractical modifier for larger acreage due to expense.
4. Raw manure: is more commonly used in agricultural applications. However, when stored properly and allowed to compost, it will stabilize nitrogen and other nutrients. Manure, in its composted form, is a viable soil conditioner; however, its use should be based on site-specific recommendations offered by a professional in this field.

5. Thoroughly rotted sawdust shall have 6 pounds of nitrogen added to each cubic yard and shall be free of stones, sticks, and toxic substances.
6. The use of treated sewage sludge has benefited from continuing advancements in its applications in the agricultural community. When composted, it offers an alternative soil amendment. Limitations include a potentially undesirable pH (because of lime added during the treatment process) and the possible presence of heavy metals. This practice should be thoroughly evaluated by a professional and be used in accordance with any local, state, and federal regulations.

Lime and Fertilizer: Lime and fertilizer needs should be determined by soil tests. Soil tests may be performed by the Cooperative Extension Service Soil Testing Laboratory at VPI & SU, or by a reputable commercial laboratory. Information concerning the State Soil Testing Laboratory is available from county extension agents. \*Under unusual conditions where it is not possible to obtain a soil test, the following soil amendments will be applied:

Lime:

Coastal Plain: 2 tons/acre pulverized agricultural grade limestone (90 lbs./1000 ft.<sup>2</sup>).

Piedmont and Appalachian Region: 2 tons/acre pulverized agricultural grade limestone (90 lbs./1000 ft.<sup>2</sup>).

Fertilizer:

Mixed grasses and legumes: 1000 lbs./acre 10-20-10 or equivalent nutrients (23 lbs./1000 ft.<sup>2</sup>).

Legume stands only: 1000 lbs./acre 5-20-10 (23 lbs./1000 ft.<sup>2</sup>) is preferred; however, 1000 lbs./acre of 10-20-10 or equivalent may be used.

Grass stands only: 1000 lbs./acre 10-20-10 or equivalent nutrients, (23 lbs./1000 ft.<sup>2</sup>). Other fertilizer formulations, including slow-release sources of nitrogen (preferred from a water quality standpoint), may be used provided they can supply the same amounts and proportions of plant nutrients.

Incorporation: Lime and fertilizer shall be incorporated into the top 4-6 inches of the soil by discing or other means whenever possible. For erosion control, when applying lime and fertilizer with a hydroseeder, apply to a rough, loose surface.

Seeding:

1. Certified seed: will be used for all permanent seeding whenever possible. Certified seed is inspected by the Virginia Crop Improvement Association or the certifying agency in other states. The seed must meet published state standards and bear an official "Certified Seed" label (see Appendix 3.32-a).
2. Legume seed: should be inoculated with the inoculant appropriate to the species. Seed of the Lespedezas, the Clovers and Crownvetch should be scarified to promote uniform germination.
3. Apply seed: uniformly with a broadcast seeder, drill, culti-packer seeder, or hydroseeder on a firm, friable seedbed. Seeding depth should be 1/4 to 1/2 inch.
4. To avoid poor germination rates as a result of seed damage during hydroseeding, it is recommended that if a machinery breakdown of 30 minutes to 2 hours occurs, 50% more seed be added to the tank, based on the proportion of the slurry remaining in the tank. Beyond 2 hours, a full rate of new seed may be necessary.

Often hydroseeding contractors prefer not to apply lime in their rigs as it is abrasive. In inaccessible areas, lime may have to be applied separately in pelletized or liquid form. Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage of

lime, fertilizer and seed.

Legume inoculants: should be applied at five times the recommended rate when inoculant is included in the hydroseeder slurry.

Mulching: All permanent seeding must be mulched immediately upon completion of seed application. Refer to MULCHING, Std. & Spec. 3.35.

### **Maintenance of New Seedings**

In general, a stand of vegetation cannot be determined to be fully established until it has been maintained for one full year after planting.

Irrigation: New seedings should be supplied with adequate moisture. Supply water as needed, especially late in the season, in abnormally hot or dry weather, or on adverse sites. Water application rates should be controlled to prevent excessive runoff. Inadequate amounts of water may be more harmful than no water.

Re-seeding: Inspect seeded areas for failure and make necessary repairs and re-seedings within the same season, if possible.

- a. If vegetative cover is inadequate to prevent rill erosion, over-seed and fertilize in accordance with soil test results.
- b. If a stand has less than 40% cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. The soil must be tested to determine if acidity or nutrient imbalances are responsible. Re-establish the stand following seedbed preparation and seeding recommendations.

Fertilization: Cool season grasses should begin to be fertilized 90 days after planting to ensure proper stand and density. Warm season fertilization should begin at 30 days after planting. Apply maintenance levels of fertilizer as determined by soil test. In the absence of a soil test, fertilization should be as follows:

#### Cool Season Grasses

- 4 lbs. nitrogen (N) per 1000 ft.<sup>2</sup> per year
- 1 lb. phosphorus (P) per 1000 ft.<sup>2</sup> per year
- 2 lbs. potash (K) per 1000 ft.<sup>2</sup> per year

Seventy-five percent of the total requirements should be applied between September 1 and December 31st. The balance should be applied during the remainder of the year. **More than 1 lb. of soluble nitrogen per 1000 ft.<sup>2</sup> should not be applied at any one time.**

#### Warm Season Grasses:

1. Apply 4-5 lbs. nitrogen (N) between May 1 and August 15th per 1000 ft.<sup>2</sup> per year.
2. Phosphorus (P) and Potash (K) should only be applied according to soil test.

\*The use of slow-release fertilizer formulations for maintenance of turf is encouraged to reduce the number of applications and the impact on groundwater.

#### Additional Information on the Successful Establishment of Grasses and Legumes

See Appendix 3.32-b for "helpful hints" in achieving high success rates in grass or legume plantings.

## APPENDIX 3.32-a SEED QUALITY CRITERIA

Where certified seed is unavailable, the min. requirements are as follows:

- a. All tags on containers of seed shall be labeled to meet the requirements of the State Seed Law.
- b. All seed shall be subject to re-testing by a recognized seed laboratory that employs a registered seed technologist or by a state seed lab.
- c. All seed used shall have been tested within twelve (12) months.
- d. Inoculant - the inoculant added to legume seed in the seed mixtures shall be a pure culture of nitrogen-fixing bacteria prepared for the species. Inoculants shall not be used later than the date indicated on the container. Twice the supplier's recommended rate of inoculant will be used on dry seedlings; five times the recommended rate if hydroseeded.
- e. The quality of the seed used shall be shown on the bag tags to conform to the guidelines in Table 3.32-E.

**TABLE 3.32-E  
QUALITY OF SEED\***

<u>Legumes</u>	<u>Minimum Seed Purity(%)</u>	<u>Minimum Germination(%)</u>
Crownvetch	98	65**
Lespedeza, Korean	97	85**
Lespedeza, Sericea	98	85**
<u>Grasses</u>		
Bluegrass, Kentucky	97	85
Fescue, Tall (Improved, Turf-Type Cultivars)	98	85
Fescue, Tall (Ky-31)	97	85
Fescue, Red	98	85
Redtop	94	80
Reed Canarygrass	98	80
Perennial Ryegrass	98	90
Weeping Lovegrass	98	87
<u>Annuals</u>		
Annual Ryegrass	97	90
German Millet	98	85
Oats	98	80
Cereal Rye	98	85

\* Seed containing prohibited or restricted noxious weeds should not be accepted. Seed should not contain in excess of 0.5% weed seed. To calculate percent pure, live seed, multiply germination times purity and divide by 100.

Example: Ky-31 Tall Fescue with a germination of 85 percent and a purity of 97 %.  
 $97 \times 85 = 8245$ .  $8245/100 = 82.45\%$  pure live seed.

\*\*Includes "hard seed"

## **APPENDIX 3.32-b**

### **KEYS TO SUCCESSFUL ESTABLISHMENT OF GRASSES AND LEGUMES**

Planning: Where feasible, grading operations should be planned around optimal seeding dates for the particular region. The most effective times for establishing perennial grass in Virginia generally extend from March through May and from August through October. Outside these dates, the probability of failure is much higher. If the time of year is not suitable for seeding a permanent cover (perennial species), a temporary cover crop should be planted. Temporary seeding of annual species (small grains, ryegrasses or millets) often succeeds during periods of the year that are unsuitable for seeding permanent (perennial) species. Variations in weather and local site conditions can modify the effects of regional climate on seeding success. For this reason, mixtures including both cool and warm season species are preferred for low-maintenance cover, particularly in the Coastal Plain. Such mixtures promote cover which can adapt to a range of conditions. Many of these mixtures are not desirable, however, for high quality lawns, where variation in texture of the turf is inappropriate. It is important to note that in Virginia the establishment of 100% warm season grasses in a high quality lawn is limited to the extreme eastern portions of the Coastal Plain.

Selection: Species selection should be considered early in the process of preparing an erosion and sediment control plan. A variety of vegetation can be established in Virginia due to the diversity in both soils and climate. However, for practical, economical stabilization and long-term protection of disturbed sites, species selection should be made judiciously. Seasonality must be considered when selecting species. Grasses and legumes are usually classified as warm or cool season in reference to their season of growth.

Cool season plants realize most of their growth during the spring and fall and are relatively inactive or dormant during the hot summer months. Therefore, fall is the most favorable time to plant them. Warm season plants "green-up" late in the spring, grow most actively during the summer, and go dormant at the time of the first frost in fall. Spring and early summer are preferred planting times for warm season plants.

Seed Mixtures: As previously noted, the establishment of high quality turf frequently involves planting one single species. However, in seedings for erosion control purposes, the inclusion of more than one species should always be considered. Mixtures need not be excessive in poundage or seed count. The addition of a quick-growing annual provides early protection and facilitates establishment of one or two perennials in a mix. More complex mixtures might include a quick-growing annual, one or two legumes and more than one perennial grass. The addition of a "nurse" crop (quick-growing annuals added to permanent mixtures) is a sound practice for soil stabilization, particularly on difficult sites - those with steep slopes; poor, rocky, erosive soils; those seeded out the optimum seeding periods; or in any situation where the development of permanent cover is likely to be slow. The nurse crop germinates and grows rapidly, holding the soil until the slower-growing perennial seedlings become established.

## APPENDIX 3.32-c PLANT INFORMATION SHEETS

### 1. **Tall Fescue** (*Festuca arundinacea*)

Uses: Pasture, hay, recreation areas, lawns and stabilization of waterways, banks, slopes, cuts, fills, and spoils. It is the most widely used grass at this time for stabilizing large disturbed areas.

Description: A robust, cool season, long-lived, deep-rooted bunchy grass which may have short rhizomes (underground stems). Kentucky 31 is the best-known variety. A number of new varieties of Tall Fescue are becoming available for lawn and other fine-turf uses, and several offer definite improvements. However, their higher cost over the old standby, KY 31, is seldom justified when used for purposes of stabilization and erosion control. Tall Fescue tolerates a wide range of seeding dates; however, with the possible exception of high mountain elevations, it is most dependable when planted in fall.

Adaptation: Adapts well to both high and low maintenance uses throughout Virginia. Adapted to a wide range of climatic conditions. Optimum pH range is 6.0 to 7.0; will tolerate from 3.0 to 8.0. Will grow on shallow and claypan soils if they are moist. Growth is limited more by moisture than by temperature extremes, but it will tolerate drought, infertile soils and shade.

Establishment: Requires a firm seedbed. Hydroseeding is successful. Seeding Rates vary from 100 lbs. per acre for erosion control to 250 lbs. per acre for lawns. Plant in early spring or from the middle of August through September. Legumes may not thrive in fescue stands due to the aggressive growth habits of this grass. Mowing is desirable on critical areas at least once every two years; lack of periodic mowing will encourage clumpiness.

Sources: Readily available as seed and sod.

### 2. **Kentucky Bluegrass** (*Poa pratense*)

Uses: Pasture, turf for lawns, athletic fields, golf courses, and playgrounds. Also used to stabilize waterways, slopes, cuts and fills. Choice food for grouse, turkeys, deer and rabbits.

Description: Long-lived, cool season perennial grass which forms a dense sod. Becomes dormant in the heat of summer since its growing season is spring and fall.

Adaptation: Best adapted to well - drained, fertile soils of limestone origin and the climate of northern and western Virginia. Optimum pH range is 6.0 to 7.0. Bluegrasses are better suited to high maintenance situations in the transitions zone. Essentially dormant during dry or hot weather; however, it will normally survive severe drought.

Establishment: Requires a firm, weed-free seedbed and adequate fertilization (liberal phosphorus) and lime are important. Can be used with Tall Fescues at low rates. Minimum mowing height is 1-1/2 inches. Critical erosion areas may be mowed only once per year, if desired. This grass is usually seeded with a mixture of other grasses or legumes; several varieties of Bluegrass should be used together to ensure good stand survival. Bare ground rates are 120 lbs. per acre. Overseed 1 to 1-1/2 lbs per 1000 square feet.

Sources: Readily available as seed and sod.

### 3. **Perennial Ryegrass** (*Lolium perenne*)

Uses: Erosion control, soil improvement, lawns, pasture, and hay; newer varieties are excellent for high-traffic areas.

Description: Perennial Ryegrasses are an excellent selection where rapid establishment is desired. Cool season Ryegrasses cross-pollinate freely so "Common Ryegrass" may be a mixture of annual and perennial species. Certified seed of Perennial Ryegrass varieties is produced: Blaser, Palmer, Goalie, Fiesta II, Ranger, Regal and Pennfine may be used in Virginia.

Establishment: A firm, shallow surface over compact subsoil gives good results. Seed in fall or spring. Perennial Ryegrass may also be seeded in Mid-August to early September. For turf, use a rate of 5 to 8 lbs. per 1000 square feet, if seeded alone; lesser amounts are suitable in mixtures, depending on the characteristics of the companion species. Generally not seeded alone except on athletic fields with intensive use. Perennial Ryegrass does best when used with Bluegrass as 20 percent or less of the mixture. Ryegrasses germinate rapidly, which makes them particularly suited to disturbed-area stabilization and temporary seeding. They will, however, tend to dominate stands in mixtures if percentage is too high.

Sources: Readily available commercially. Care should be taken to buy seed appropriate to the needs of the project.

### 4. **Bermudagrass** (*Cynodon dactylon*)

Uses: Soil and water conservation, pasture, hay, silage, lawns, both high maintenance and general purpose turf, and stabilization of grassed waterways.

Description: A long-lived, warm season perennial that spreads by stolons and rhizomes (runners and underground stems). Height of stems of Common Bermudagrass may be 12 inches. The stems are short-jointed and the leaves flat and spreading.

Common Bermudagrass may be established vegetatively with sprigs (sections of stems) or from seeds; however, it has the potential to develop into a weed problem because it spreads vigorously. Cold-tolerant hybrids are usually specified. These are traditionally established from sprigs or sod, but seed is now available.

Adaptation: Southern Piedmont and Coastal Plain in Virginia and some southern Appalachian ridges and valleys. Check Std. & Spec. 3.34 for regional adaptations of varieties. Makes its best growth when average daily temperatures are above 75 degrees. Grows on a wide range of soils from heavy clays to deep sands. Optimum pH is 6.0 to 6.5. It is drought-resistant and salt-tolerant. Tolerates floods of short duration but will not thrive on waterlogged soils; does not persist under heavy shade. For rough areas, the varieties Midland (a forage hybrid) and Coastal are recommended. For fine-turf areas, Tufcote (a fine-leaved turf hybrid), Midiron, Tifway, and Vamont are used in Virginia.

Establishment: By sodding or planting sprigs. Sprigs should be planted (by hand or machine) when soil is warm in a well-prepared, moist seedbed. One end of the sprig should extend above ground, and the other should be covered by firmly packed soil.

Sources: Readily available as seed, sprigs, and sod.

#### 5. **Redtop** (*Agrostis alba*)

Uses: Erosion control, pasture, companion grass in turf seedings and stabilizing ditch and channel banks, grassed waterways, and other disturbed areas.

Description: A coarse, cool season perennial grass with rhizomes (underground stems). Grows to 30 to 40 inches.

Adaptation: Throughout Virginia; does better in the cool, humid areas. Will grow under a wide variety of soil and moisture conditions. Grows on very acid soils of low fertility. While drought-resistant, it is also a useful wetland grass.

Establishment: Has very small seed and requires a compact seedbed. May be sown in early spring or late summer. Seldom seeded alone except as temporary turf. Adequate fertilization is essential on critical areas to obtain good cover rapidly. Most commonly added to mixes, usually 2 to 3 lbs. per acre. Redtop will disappear from a stand under frequent low mowing.

#### 6. **Crownvetch** (*Coronilla varia*)

Uses: For erosion control of critical areas such as steep roadbanks, surface mine spoils and industrial waste areas. It is also useful as a residential ground cover. It provides high-quality forage for ruminant animals and serves as a wildlife food and cover plant.

Description: A deep-rooted, cool season, perennial, herbaceous legume with a semi-reclining growth habit. It reaches 2 to 3 feet in height, and does not climb or twine. It fixes nitrogen in the soil and makes a dense mat of vegetative cover.

Adaptation: Best adapted to the northern Piedmont and Mountain regions of Virginia. It grows best on well-drained soils with a pH range of 5.5 to 8.3. It will persist on more acid soils for a prolonged period once established. It is not adapted to soils with poor drainage. Crownvetch is winter-hardy and drought tolerant. Varieties commonly used are Chemung, Penngift, and Emerald.

Establishment: Only inoculated seed should be used. Requires at least 500 lbs. per acre of 5-10-10 fertilizer (or the area should be fertilized according to soil test results). Soil acidity must be raised above a pH of 5.5. Crownvetch requires mulch and can be hydroseeded successfully.

Seeding in the spring is most successful. Frost-seeding may be used on steep or stony sites (seed in late winter, and allow frost action to work the seed into soil). Crownvetch often takes 2 to 3 years to establish a dense stand. A companion grass such as Perennial Ryegrass or Redtop needs to be mixed into the initial planting, but the Crownvetch will eventually crowd out the companion plants. It will not persist under frequent mowing.

7. **Sericea Lespedeza** (Lespedeza cuneata)

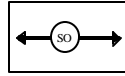
Uses: Hay, pasture, erosion control, cover crop, wildlife food.

Description: Warm season perennial legume with upright woody stems 12 to 18 inches tall. Roots widely branched penetrating soil 3 feet or more.

Adaptation: Well adapted to all parts of Virginia. Best on well-drained, deep soils of medium texture. Will also grow on sandy, rather acidic, infertile soils. Most often the legume of choice for eastern Virginia. Optimum pH range is 6.0 to 6.5, but will tolerate a range of 5.0 to 7.0. It is drought-tolerant. Common varieties in Virginia are Serala and Interstate.

Establishment: Seed from April to June. Requires a firm seedbed. Use only inoculated seed. Rates vary from 20 to 30 lbs. of unhulled seed per acre. Requires phosphate and potash. Will not persist under frequent mowing (once a year recommended).

## STD & SPEC 3.33 SODDING



### Practice Description

Stabilizing fine-graded disturbed areas by establishing permanent grass stands with sod. It is utilized for the following:

1. To establish permanent turf immediately.
2. To prevent erosion and damage from sediment and runoff by stabilizing the soil surface.
3. To reduce the production of dust and mud associated with bare soil surfaces.
4. To stabilize drainageways where concentrated overland flow will occur.
5. For use as a filtering device for sediments in areas prior to achieving permanent stabilization.

### Conditions Where Practice Applies

1. Disturbed areas which require immediate vegetative covers, or where sodding is preferred to other means of grass establishment.
2. Locations particularly suited to stabilization with sod are:
  - a.) Waterways carrying intermittent flow
  - b.) Around drop inlets or in grassed swales
  - c.) Residential or commercial lawns where quick use or aesthetics are factors

### Specifications

#### Soil Preparation

1. Prior to soil preparation, areas to be sodded shall be brought to final grade in accordance with the approved plan.
2. Soil tests should be made to determine the exact requirements for lime and fertilizer. The State Laboratory at VPI & SU or a reputable commercial laboratory may conduct soil tests. Information on state soil tests is available from county or city agricultural extension agents. \*Under circumstances where it is not possible to obtain a soil test, the following soil amendments shall be made:  
Pulverized agricultural limestone at 90 lbs./1000 sq. ft. (2 tons/acre).  
Fertilizer at 25 lbs./1000 sq. ft. (1000 lbs./acre) of 10-10-10 in fall, or 25 lbs./1000 sq. ft. of 5-10-10 in spring. These amendments shall be spread evenly over the area to be sodded, and incorporated into the top 3 to 6 inches of the soil by discing, harrowing or other means.
3. Prior to laying sod, the soil surface shall be clear of trash, debris, large roots, branches, stones and clods in excess of 1 inch in length or diameter. Sod shall not be applied to gravel or other non-soil surfaces.
4. Any irregularities in the soil surface resulting from top-soiling or other operations shall be filled or leveled in order to prevent the formation of depressions or water pockets.
5. Areas to be topsoiled and topsoil used shall fulfill the requirements of TOPSOILING, Std. & Spec. 3.30. No sod shall be spread on soil which has been treated with soil sterilants or any other toxic herbicides until enough time has elapsed to permit dissipation of toxic materials.

### Quality of Sod

1. Sod used shall be state-certified. Certified turfgrass sod is grown from Certified seed, inspected and certified by the Virginia Crop Improvement Association (VCIA) or the certifying agency in other states. This ensures genetic purity, high quality, freedom from noxious weeds and excessive insect or disease problems. The sod must meet published state standards and bear an official blue "Certified Turf" label on the bill of lading.
2. High-quality sod is also available outside of the VCIA certified sod program. When purchasing this sod, the consumer is encouraged to be aware of factors which are important in determining sod quality. High-quality sod will contain the best varieties and be free of serious disease, insect, or weed problems. It will be dense, have good color, and hold together well.
3. Sod shall be machine cut at a uniform soil thickness of 3/4 inch ( $\pm$  1/4 inch) at the time of cutting. This thickness shall exclude shoot growth and thatch.
4. Pieces of sod shall be cut to the supplier's standard width and length, with a maximum allowable deviation in any dimension of 5%. Torn or uneven pads will not be acceptable.
5. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended from a firm grasp on one end of the section.
6. Sod shall not be cut or laid in excessively wet or dry weather.
7. **Sod shall be harvested, delivered, and installed within a period of 36 hours.**

### Choosing Appropriate Types of Sod

The type of sod used must be composed of plants adapted to the locality. Use Table 3.33-A to select the type of sod best suited to your area.

### Sod Installation (See Plate 3.33-1)

1. Sod should not be laid on soil surfaces that are frozen.
2. During periods of high temperature, the soil shall be lightly irrigated immediately prior to laying the sod, to cool the soil and reduce root burning and dieback.
3. The first row of sod shall be laid in a straight line with subsequent rows placed parallel to and butting tightly against each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause drying of the roots.
4. On slopes 3:1 or greater, or wherever erosion may be a problem, sod shall be laid with staggered joints and secured by stapling or other approved methods. Sod shall be installed with the length perpendicular to the slope (on the contour).
5. As sodding of clearly defined areas is completed, sod shall be rolled or tamped to provide firm contact between roots and soil.
6. After rolling, sod shall be irrigated to a depth sufficient that the underside of the sod pad and the soil 4 inches below the sod are thoroughly wet.
7. Until such time a good root system becomes developed, in the absence of adequate rainfall, watering shall be performed as often as necessary to maintain moist soil to a depth of at least 4 inches.
8. The first mowing shall not be attempted until the sod is firmly rooted, usually 2-3 weeks. Not more than one third of the grass leaf shall be removed at any one cutting.

### Sodded Waterways

1. Care should be taken to prepare the soil adequately in accordance with this specification. The sod type shall consist of plant materials able to withstand the designed velocity (see STORMWATER CONVEYANCE CHANNELS, Std. & Spec. 3.17).
2. Sod strips in waterways shall be laid perpendicular to the direction of flow. Care should be taken to butt ends of strips tightly.
3. After rolling or tamping, sod shall be pegged or stapled to resist washout during the establishment period. Jute mesh or other netting may be pegged over the sod for extra protection in critical areas.
4. All other specifications for this practice shall be adhered to when sodding a waterway.

**TABLE 3.33-A  
TYPE OF SOD AVAILABLE IN VIRGINIA  
AND RECOMMENDED USES**

**Kentucky Bluegrass:** Adapted to the Northern Piedmont and Mountain Regions. Individual varieties selected must make up not less than 10%, not more than 35% of the total mixture on a weight basis. All varieties must be certified. Selections can be made from Category I alone or various combinations of Categories I, II and III, as noted.

**Category I:** Recommended Kentucky Bluegrass Varieties

65% - 100% A-34, Abbey, Aspen, Asset, Baron, Blacksburg, Bristol, Cheri, Chateau, Classic, Coventry, Georgetown, Glade, Haga, Julia, Liberty, Loft's 1757, Merit, Midnight, Monopoly, Plush, Princeton 104, Rugby, Suffolk, Victa

**Category II:** Special use varieties. If used, must contain at least 65% Category I varieties

**Shade Tolerant**

10-35% Bristol, Columbia, Georgetown, Glade, Midnight

**Low-Maintenance Tolerant**

10-35% Columbia, Georgetown, Monopoly, Ram I, Touchdown, Victa

**Category III:** Promising Kentucky Bluegrass - Limited performance data or seed availability

10-35% Dawn, Estate, Freedom, Kelly

### Maintenance of Established Sod

1. During the 2 to 3 week establishment stage, sod shall be watered as necessary to maintain adequatemoisture in the root zone and prevent dormancy of sod.
2. No more than one third of the shoot (grass leaf) should be removed in any mowing. Grass height should be maintained between 2 and 3 inches unless otherwise specified.
3. After the first growing season, established sod will require fertilization and may require lime. Follow soil test recommendations when possible, or apply maintenance levels as outlined in Table 3.33-B.

**TABLE 3.33-A (CONTINUED)**  
**SOD TYPES AVAILABLE**  
**IN VIRGINIA & RECOMMENDED USES**

**Tall Fescue:** Adapted to the entire state.

Recommended Tall Fescue Varieties:

90-100% Amigo, Apache, Bonanza, Chieftain, Finelawn 5GL, Mesa, Rebel II, Shenandoah, Tribute

Promising Tall Fescues

Certified Arriba, Austin, Avanti, Aztec, Cochise, Crossfire, Eldorado, Hubbard 87, Jaguar II, Maverick II, Monarch, Olympic II, Phoenix, Safari, Shortstop, Sundance, Taurus, Thoroughbred, Titan, Tradition, Vegas, Winchester, Wrangler

0-10% Kentucky Bluegrass: Baron, Cheri, Columbia, Monopoly, Nassau, Ram I, Victa

**Bermuda grass:** Tufcote is adapted to the Richmond-Danville-Newport News triangle. Midiron may be used east of Roanoke and south of Charlottesville. Tifgreen and Tifway may be used to the east and south of Richmond. Vamont may be used east of Roanoke and at lower elevations in southwestern Virginia.

Certified Midiron, Tifgreen#, Tifway, Tifway II, Tufcote and Vamont

**Zoysiagrass:** This sod performs best in southeastern Virginia. Meyer, Emerald#

**Note:** Common Bermudagrass is not recommended for sod production.

# Only recommended in southeastern Virginia.

# SODDING



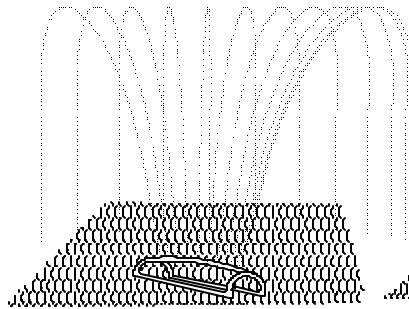
LAY SOD IN A STAGGERED PATTERN. BUTT THE STRIPS TIGHTLY AGAINST EACH OTHER. DO NOT LEAVE SPACES AND DO NOT OVERLAP. A SHARPENED MASON'S TROWEL IS A HANDY TOOL FOR TUCKING DOWN THE ENDS AND TRIMMING PIECES.



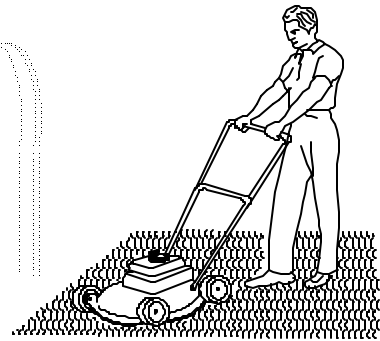
**BUTTING** — ANGLED ENDS CAUSED BY THE AUTO-MATIC SOD CUTTER MUST BE MATCHED CORRECTLY.



ROLL SOD IMMEDIATELY TO ACHIEVE FIRM CONTACT WITH THE SOIL.

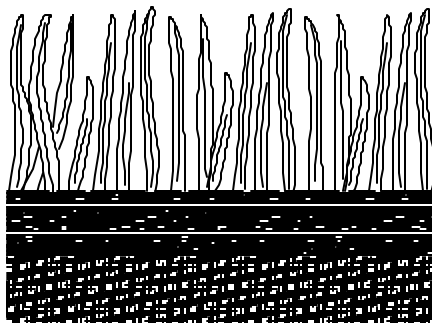


WATER TO A DEPTH OF 4" AS NEEDED. WATER WELL AS SOON AS THE SOD IS LAID.



MOW WHEN THE SOD IS ESTABLISHED — IN 2-3 WEEKS. SET THE MOWER HIGH (2"-3")

## APPEARANCE OF GOOD SOD



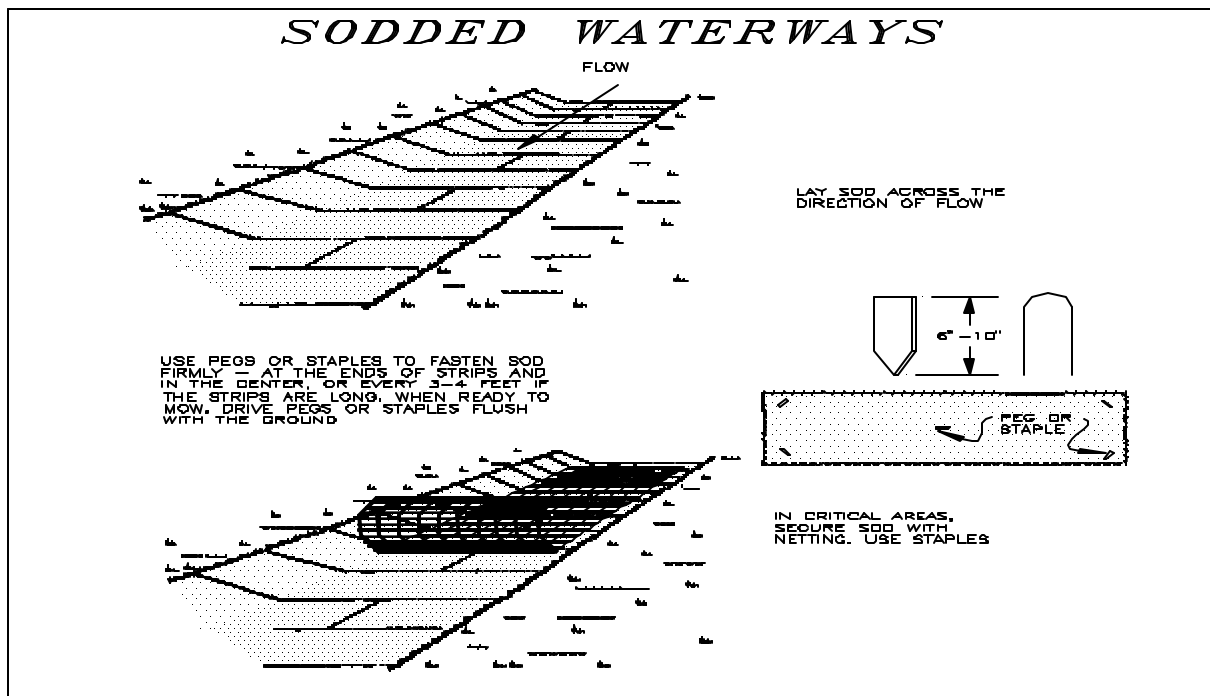
**SHOOTS OR GRASS BLADES** — GRASS SHOULD BE GREEN AND HEALTHY, MOWED AT A 2"-3" CUTTING HEIGHT

**THATCH** — GRASS CLIPPINGS AND DEAD LEAVES, UP TO 1/2" THICK.

**ROOT ZONE** — SOIL AND ROOTS, SHOULD BE 1/2"-3/4" THICK, WITH DENSE ROOT MAT FOR STRENGTH.

SOURCE: VA. DSWC

PLATE: 3.33-1



SOURCE: VA. DSWC

PLATE: 3.33-2

**TABLE 3.33-B  
MAINTENANCE FERTILIZATION  
OF ESTABLISHED SOD**

**Cool Season Grasses**

4 lbs. nitrogen (N) per 1000 sq. ft./year  
1 lb. phosphorus (P) per 1000 sq. ft./year  
2 lbs. Potash (K) per 1000 sq. ft./year

75% of the total requirements should be applied between September 1 and December 31st. The balance should be applied during the remainder of the year.

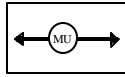
**Warm Season Grasses**

Apply 4-5 lbs. nitrogen (N) per 1000 sq. ft. per year (between May 1<sup>st</sup> and August 15th).

Phosphorus (P) and Potash (K) should only be applied according to soil tests.

Maintenance fertilizations should utilize slow release fertilizers which reduce the number of applications per year and subsequently reduce the adverse impacts on groundwater.

## STD & SPEC 3.35 MULCHING



### **Practice Description**

Application of plant residues or other suitable materials to the soil surface, to prevent erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow and to foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

### **Conditions Where Practice Applies**

1. Areas which have been permanently seeded (see Std. & Spec. 3.32, PERMANENT SEEDING) should be mulched immediately following seeding.
2. Areas which cannot be seeded because of the season should be mulched to provide some protection to the soil surface. An organic mulch should be used, and the area then seeded as soon weather or seasonal conditions permit. It is not recommended that fiber mulch be used alone for this practice; at normal application rates it just simply does not provide the protection that is achieved using other types of mulch.
3. Mulch may be used together with plantings of trees, shrubs, or certain ground covers which do not provide adequate soil stabilization by themselves.
4. Mulch shall be used in conjunction with temporary seeding operations as specified in TEMPORARY SEEDING, Std. & Spec. 3.31.

### **Specifications**

#### **Organic Mulches**

Organic mulches may be used in any area where mulch is required, subject to the restrictions noted in Table 3.35-A.

**Materials:** Select mulch material based on site requirements, availability of materials, and availability of labor and equipment. Table 3.35-A lists the commonly used organic mulches. Materials, such as peanut hulls and cotton burs, may be used with the permission of the local Plan-Approving Authority.

**Prior to mulching:** Complete the required grading and install needed sediment control practices.

**Lime and fertilizer** should be incorporated and **surface roughening** accomplished as needed. Seed should be applied **prior to mulching** except in the following cases:

- a. Where seed is to be applied as part of hydroseeder slurry containing fiber mulch.
- b. Where seed is to be applied following a straw mulch spread during winter months.

**TABLE 3.35-A  
ORGANIC MULCH MATERIALS AND APPLICATION RATES**

MULCHES:	RATES:		NOTES:
	Per Acre	Per 1000/SQ. FT.	
Straw or Hay	1 1/2 -2 tons (Min. 2 tons for winter cover)	70-90 lbs.	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	Minimum 1500 lbs.	35 lbs.	Do not use as mulch for winter cover or during hot, dry periods* Apply as slurry.
Corn Stalks	4-6 tons	185-275 lbs.	Cut or Shredded in 4-6" lengths. Air- dried. Do not use in fine turf areas. Apply with mulch blower or by hand.
Wood Chips	4-6 tons	185-275 lbs.	Free of coarse matter. Air-dried. Treat with 12 lbs. nitrogen per ton. Do not use in fine turf areas. Apply with mulch blower or by hand.
Bark Chips or Shredded Bark	50-70 cu. yds.	1-2 cu. yds	Free of coarse matter. Air-dried. Treat with 12 lbs. nitrogen per ton. Do not use in fine turf areas. Apply with mulch blower,chip handler or by hand.
* When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2000 lbs./ac. or 45 lbs./1000 sq. ft.			

Application: Mulch materials shall be spread uniformly, by hand or machine.

When spreading straw mulch by hand, divide the area to be mulched into approximately 1,000 sq. ft. sections and place 70-90 lbs. (1~~½~~ 2 bales) of straw in each section to facilitate uniform distribution.

Mulch Anchoring: Straw mulch must be anchored immediately after spreading to prevent displacement. Other organic mulches listed in Table 3.35-A do not require anchoring. The following methods of anchoring straw may be used:

1. Mulch anchoring tool (often referred to as a Krimper or Krimper Tool): This is a tractor-drawn implement designed to punch mulch into the soil surface. This method provides good erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.
2. Fiber Mulch: A very common practice with widespread use today. Apply fiber mulch by means of a hydroseeder at a rate of 500-750 lbs./acre over top of straw mulch or hay. It has an added benefit of providing additional mulch to the newly seeded area.
3. Liquid mulch binders: Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks, to prevent displacement. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread or may be sprayed into the mulch as it is being blown onto the soil.

The following types of binders may be used:

- a. Synthetic binders - Formulated binders or organically formulated products may be used as recommended by the manufacturer to anchor mulch.
4. Mulch nettings: Lightweight plastic, cotton, or paper nets may be stapled over the mulch according to manufacturer's recommendations.

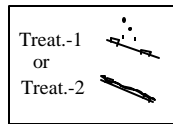
#### Chemical Mulches

Chemical mulches may be used in accordance with the manufacturers recommendations.

### **Maintenance**

All mulches and soil coverings should be inspected periodically (particularly after rainstorms) to check for erosion. Where erosion is observed in mulched areas, additional mulch should be applied. Nets and mats should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re-install netting or matting as necessary after repairing damage to the slope or ditch. Inspections should take place up until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; repair as needed.

## STD & SPEC 3.36 SOIL STABILIZATION BLANKETS & MATTING



### Practice Description

The installation of a protective covering (blanket) or a soil stabilization mat on a prepared planting area of a steep slope, channel or shoreline, to aid in controlling erosion on critical areas by providing a microclimate which protects young vegetation and promotes its establishment. In addition, some types of soil stabilization mats are also used to raise the maximum permissible velocity of turf grass stands in channelized areas by "reinforcing the turf" to resist the forces of erosion during storm events.

### Conditions Where Practice Applies

On short, steep slopes where erosion hazard is high and planting is likely to be too slow in providing adequate protective cover; in vegetated channels where the velocity of design flow exceeds "allowable" velocity; on streambanks or tidal shorelines where moving water is likely to wash out new plantings; or in areas where the forces of wind prevent standard mulching practices from remaining in place until vegetation becomes established.

### TREATMENT-1: SOIL STABILIZATION BLANKET

(Allowable Velocity Range During Vegetation Establishment: 0-4 f.p.s)

### Materials

1. Combination Blankets - Shall consist of a photo-degradable plastic netting which covers and is entwined in a natural organic or man-made mulching material. The mulching material shall consist of wood fibers, wood excelsior, straw, coconut fiber, or man-made fibers. The blanket shall be of consistent thickness with the mulching material/fibers evenly distributed over its entire length. The mulching material/fibers must interlock or entwine to form a dense layer that not only resists raindrop impact, but will allow vegetation to penetrate the blanket. The blanket shall be nontoxic to vegetation and to the germination of seed and shall not be injurious to the unprotected skin of humans. At a minimum, the plastic netting must cover the top side of the blanket and possess a high web strength. The netting shall be entwined with the mulching material/fiber to maximize strength and provide for ease of handling.
2. Jute Mesh - It shall be a uniform, open, plain weave, of undyed and unbleached single jute yarn. The yarn shall be a loosely twisted construction and shall not vary in thickness by more than one half of its normal diameter. Jute mesh shall be new and shall conform to the following:
  - a. Length of jute mesh shall be marked on each roll.
  - b. There shall be 0.60-inch openings (+/- 25%) between strands, lengthwise.
  - c. There shall be 0.90-inch openings (+/- 25%) between strands, widthwise.

- d. Weight shall average 0.90 lbs./square yard with a tolerance of 5%.

As previously noted, jute can be used alone as a blanket.

2. Other **Treatment-1** Products - These shall conform to manufacturer's specifications and be approved by the Plan-Approving Authority prior to being specified for a particular application. These products should be installed in accordance with manufacturer's recommendations, provided those recommendations are at least as stringent as this specification. Again, it is recommended that VDOT's "Approved Products List" be consulted. In no case shall these products cover less than 30% of the soil surface.
3. Staples - Staples for anchoring Treatment-1 shall be No. 11-gauge wire or heavier. Their length shall be a minimum of 6 inches. A larger staple with a length of up to 12 inches should be used on loose, sandy, or unstable soils.

### **Installation Requirements**

Site Preparation - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1½ inches in diameter and any foreign material that will prevent uniform contact of the protective covering with the soil surface.

Planting - Lime, fertilize, and seed in accordance with seeding or other type of planting plan. When using jute mesh on a seeded area, apply approximately one-half the seed after laying the mat. The protective covering can be laid over sprigged areas where small grass plants have been inserted into the soil.

Where ground covers are to be planted, lay the protective covering first and then plant through the material as per planting design.

When open-weave nets are used, lime, fertilizer, seed and mulch should be applied before laying the net. When a combination blanket (such as an "excelsior" blanket) is used, seed and soil amendments must also be applied before the blanket is laid.

Orientation - See Manufacturer's specifications for orientation of **Treatment-1** for different topographic conditions.

Laying and Stapling (see Plate 3.36-2) - If instructions have been followed, all needed check slots will have been installed, and the protective covering will be laid on a friable seedbed free from clods, rocks, roots, etc. that might impede good contact.

1. Start laying the protective covering from the top of the channel or top of slope and unroll down-grade.
2. Allow to lay loosely on soil - do not stretch.
3. Upslope ends of the protective covering should be buried in an anchor slot no less than 6-inches deep. Tamp earth firmly over the material. Staple the material at a minimum of every 12 inches across the top end.

4. Edges of the material shall be stapled every 3 feet. Where multiple widths are laid side by side, the adjacent edges shall be overlapped a minimum of 2 inches and stapled together.
5. Staples shall be placed down the center, staggered with the edges at 3 foot intervals.

Check slots - On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 50 feet (see Plate 3.36-2). Insert a fold of the material (separate piece) into a 6-inch trench and tamp firmly. Staple fold to "main" blanket at minimum 12-inch intervals across the upstream and downstream portion of the blanket.

Note: Many combination blankets are designed and manufactured to resist movement and uplift to a point which check slots may not be required. Plan designers and review authorities are urged to study manufacturers' recommendations and site conditions.

Joining Protective Coverings - Insert a new roll of material into an anchor slot, as with upslope ends. Overlap the end of the previous roll a minimum of 12 inches, and staple across the end of the roll just below the anchor slot and across the material every 12 inches.

Terminal End - At the point at which the material is discontinued, or at which time the protective covering meets a structure of some type, fold 4 inches of the material underneath and staple every 12 inches (minimum).

At bottom of slopes - Lead net out onto a level area before anchoring. Turn ends under 4 inches, and staple across end every 12 inches.

Final Check - These installation techniques must be adhered to:

1. Protective blanket is in uniform contact with the soil.
2. All lap joints are secure.
3. All staples are driven flush with the ground.
4. All disturbed areas have been seeded.

## **TREATMENT-2: SOIL STABILIZATION MATTING**

(Allowable velocity range after vegetative establishment: 0 - 10 f.p.s.)

### **Materials**

**Matting** - The majority of these products provide a three dimensional geomatrix of nylon, polyethylene, or randomly oriented monofilaments, forming a mat. These products contain ultra violet (UV) inhibiting stabilizers, added to the compounds to ensure endurance and provide "permanent root reinforcement."

The three dimensional feature creates an open space which is allowed to fill with soil. The roots of the grass plant become established within the mat itself, forming a synergistic root and mat system. As the grass becomes established, the two actually "reinforce" each other, preventing movement or damage to the soil. Allowable velocities are increased considerably over natural turf stands.

Selection of the appropriate matting materials along with proper installation become critical factors in the success of this practice. VDOT's "Approved Products List" can be a real asset in the selection process. Consultation with the supplier or the manufacturer and thorough evaluation of performance data to ensure proper selection of a soil stabilization matting are also essential. Although many manufacturers claim their products may inhibit erosion associated with channel velocities of up to 20 ft./sec., it is recommended that any velocities that exceed 10 ft./sec. be properly protected with some form of structural lining (see Std. & Spec. 3.17, STORMWATER CONVEYANCE CHANNEL).

**Staples** - Staples or anchoring methods and recommendations vary by manufacturers. The expectation of high velocities should dictate the use of more substantial anchoring.

### **Installation Requirements**

**Site Preparation** - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1 inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. If necessary, redirect any runoff away from the ditch or slope during installation.

**Planting** - Lime, fertilize and seed in accordance with MS #1 and the approved plan, paying special attention to the plant selection that may have been chosen for the matted area. If the area has been seeded prior to installing the mat, make sure and reseed all areas disturbed during installation.

**Mulching** - Mulch (normally straw) should be applied following installation of **Treatment-2** at rates noted in Std. & Spec. 3.35, MULCHING.

**Laying and Securing** - See Plates 3.36-4, 3.36-5 and 3.36-6. Similar to installing **Treatment-1**, but Plan Approving Authority's requirements or manufacturer's recommendations must be followed as detailed. The key to achieving desired performance is dependent upon proper installation.

**Check Slots** - See Plate 3.36-4. Matting manufacturers vary significantly in their check slot requirements. Similar to the installation of **Treatment-1**, a check slot may be required when laying **Treatment-2** to

"correct" the flow of water if it has the potential to undermine the matting. Most authorities (including VDOT) require that the sides of the matting also be entrenched, creating a slope shelf for the material to rest on, preventing water from entering under the mat on the sides.

Securing the Material and Joining Mats - Again, product specifications vary - upstream and downstream terminal slots, new roll overlaps and multiple width installations differ by various products and manufacturers.

Final Check - These installation techniques must be adhered to:

1. Soil stabilization mat is in uniform contact with the soil.
2. All required slots and lapped joints are in place.
3. The material is properly anchored.
4. All disturbed areas are seeded.

### **Maintenance**

All soil stabilization blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, re-install the material after repairing damage to the slope or ditch. Continue to monitor these areas until which time they become permanently stabilized; at that time an annual inspection should be adequate.